Ultra SCSI XIO™ Board Owner's Guide

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About This Guide

The Ultra SCSI XIO™ option provides up to four additional external SCSI (small computer systems interface) ports for the Origin™ family of Origin2000 or Onyx2™ servers and graphics workstations.

Audience

This guide is written for owners and users of the Ultra SCSI option board. It presumes general knowledge of SCSI, knowledge of the host system in which the Ultra SCSI option board is installed, and knowledge of the SCSI devices to which the Ultra SCSI board ports are to be cabled.

Structure of This Document

This guide consists of the following chapters:

- Chapter 1, “Features of the Ultra SCSI XIO Board,” describes Ultra SCSI option board outputs, compatible media, and cables. It also explains SCSI basics.
- Chapter 2, “Ultra SCSI Option Topologies,” explains Ultra SCSI option topologies.
- Appendix A, “Ultra SCSI 68-Pin Connector Pinouts,” gives pinouts for the P connectors on the cables supplied with the option.

Besides this manual, have handy the owner’s guide for the server or workstation in which the Ultra SCSI board is installed, and the owner’s guide for the peripheral device(s) with which the Ultra SCSI board interfaces.

Chapter 1

Features of the Ultra SCSI XIO Board

The Ultra SCSI external SCSI expander XIO board is a half-height XIO board (marketing code XT-SCSI-4P) that provides expansion capability for the Origin2000 server or Onyx2 workstation. It can be installed in certain XIO slots in those chassis.

Each of the four controllers on the Ultra SCSI option board supports fast and wide SCSI (Fast-20) data transfer rates. The SCSI controller is compliant with ANSI Fast-20 standard X3T10/1071D and ANSI SCSI-2 standard X3.131-1994.

Figure 1-1 shows features of the Ultra SCSI option board.

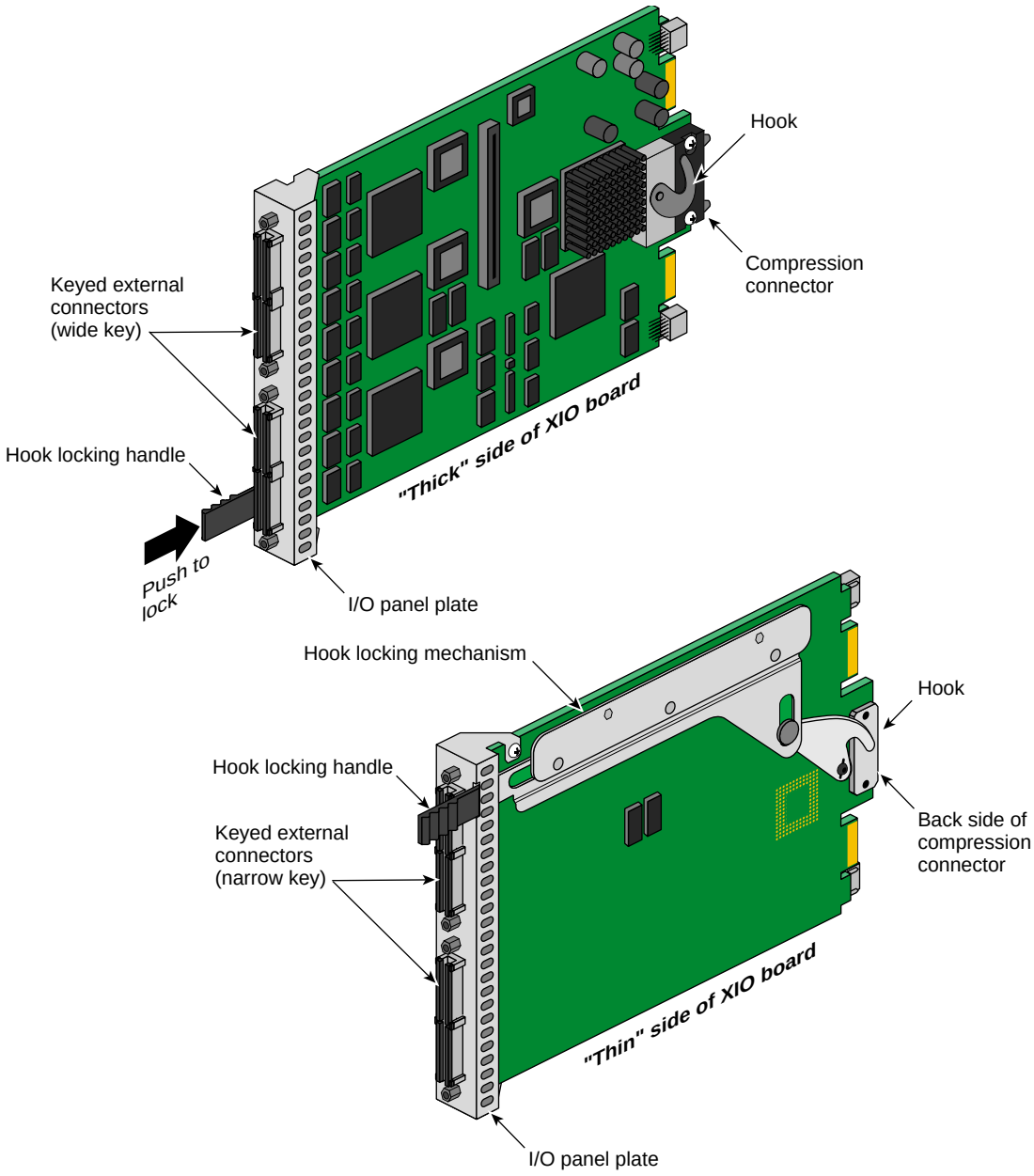

Figure 1-1 Ultra SCSI XIO Board

Figure 1-2 diagrams the Ultra SCSI board.

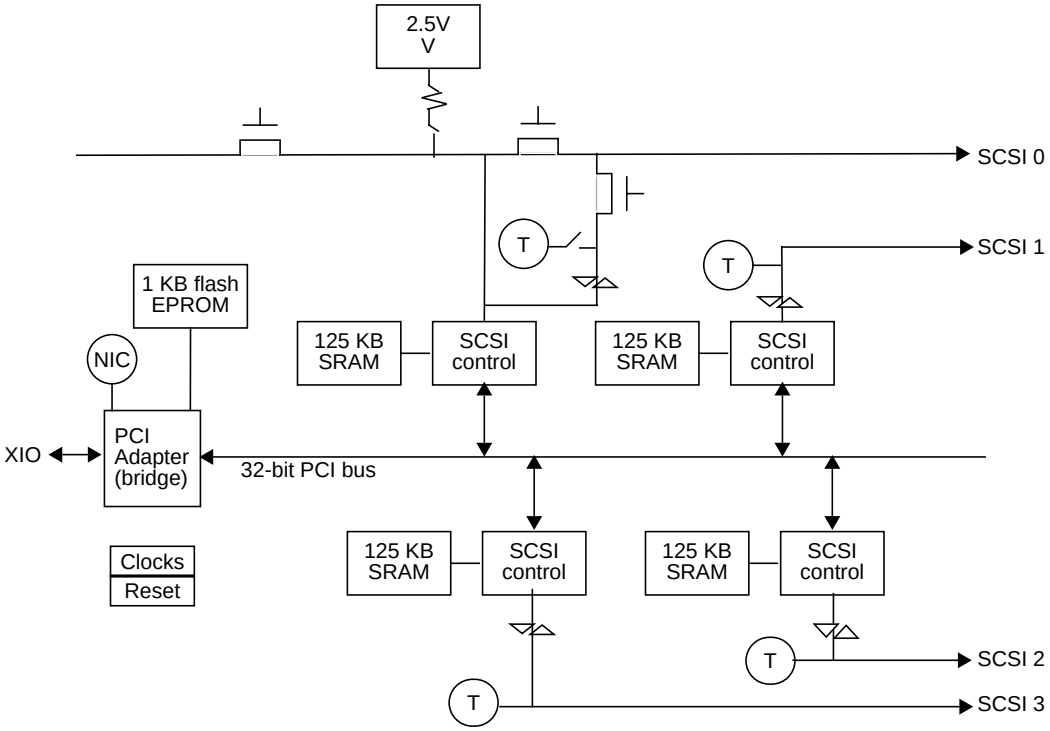

Figure 1-2 Ultra SCSI Board Diagram

This chapter describes

- Ultra SCSI XIO board outputs
- Ultra SCSI XIO board compatible media
- cables
- SCSI basics

Ultra SCSI XIO Board Outputs

The Ultra SCSI XIO board provides these outputs:

- Three differential Fast-20 external SCSI channels (1, 2, and 3)

  By default, these channels are terminated on the board; termination can be disabled to allow hot plugging of controllers when a cable with built-in termination is used.

- One channel (0) that can be used as one of the following:
  - external differential Fast-20
  - internal single-ended Fast-20, which activates internal SCSI for a host in which the Ultra SCSI board is installed in XIO slot 1 instead of an IO6 board
  - external single-ended Fast-20-capable

  If the Ultra SCSI board is not in XIO slot 1, SCSI channel 0 selects the appropriate configuration, depending on the external SCSI device that is connected to it. Termination at the controller is determined automatically by the state of the channel's DIFFSENS signal (pin 16 on the SCSI P connector socket) from the attached external device. If the external device is differential and the differential transceivers are enabled, DIFFSENS is high and the termination at the controller is differential. If the external device is single-ended, DIFFSENS is low and the termination at the controller is single-ended. The channel's differential transceivers are disabled.

  When the Ultra SCSI board is in XIO slot 1, its default configuration is external Fast-20.

Ultra SCSI XIO Board Compatible Media

Fast-20 ("Ultra SCSI") is a 16-bit wide SCSI bus running at 20 MHz (40 MB/second). Ultra SCSI channel 0 supports

- Internal Fast-20 single-ended devices

  If the Ultra SCSI board is in XIO slot 1 in an Origin2000 chassis, a socket on the midplane connects the board to the chassis internal SCSI channel. In a system with no IO6 board, this connection enables the internal disk drives and CD-ROM drive to be used.

- External devices:
  - slow, Fast-10, or Fast-20
  - wide or narrow
  - single-ended (attached to Ultra SCSI board channel 0 only) or differential
- Removable media SCSI devices (typically single-ended) as summarized in Table 1-1

Table 1-1 Supported Removable Media SCSI Devices

Device	Internal	External
CD-ROM drive	x	x
Digital linear tape drive	x	x
8-mm tape drive		x
4-mm digital audio tape drive	x	x
QIC (1/4-inch tape) drive		x
Scanner		x
Color laser printer		x

An external device must be differential, unless it is attached to Ultra SCSI board channel 0.

Cables

Two Y cables included in the option connect the two double ports on the board to as many as four SCSI channels, as diagrammed in Figure 1-3.

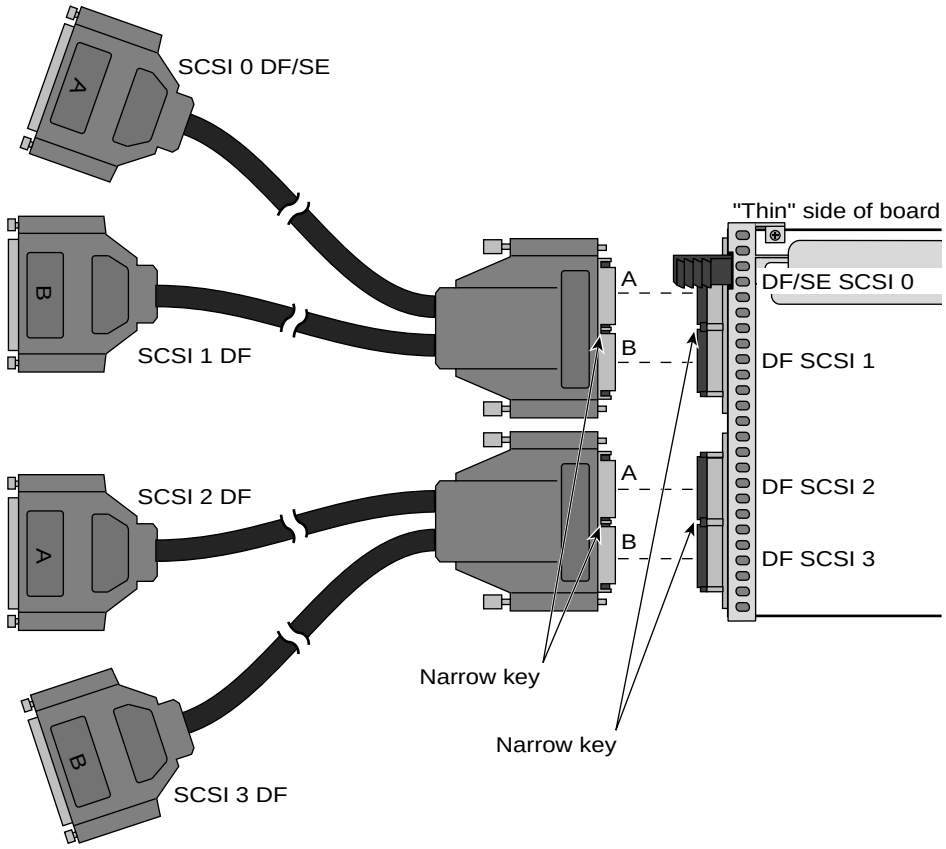

Figure 1-3 Ultra SCSI Board Connectors and Cables

Note that the ports and the cable connectors are keyed so that the cables cannot be inserted incorrectly. The high-density double cable connectors that connect to the ports are labeled **A** and **B** on the wide-keyed side:

- **A** corresponds to channel 0 (top connector) and 2 (bottom connector)
- **B** corresponds to channel 1 (top connector) and 3 (bottom connector)

The labels on the cables near the P (standard 68-pin SCSI) connectors indicate the XIO slot, and SCSI channel. In a multi-module system, a label designating the module (host) can also be present.

SCSI Basics

This section explains

- SCSI channels and devices
- SCSI buses
- configuring a SCSI channel

SCSI Channels and Devices

The Ultra SCSI board supports four channels; each channel can support an Origin Vault storage option. Each Origin Vault can contain up to six 4.5 GB or 9.1 GB 3.5-inch disk drives as well as one or two 5.25-inch SCSI-2 peripherals.

SCSI devices continue to evolve with higher bus bandwidths, faster data transfer rates, and channels with longer cables and more devices. A *protocol* establishes a SCSI bus's bandwidth, type, and data transfer rate. These factors are interdependent. For example, a 16-bit SCSI peripheral typically transfers more data at a faster rate than an 8-bit SCSI peripheral.

SCSI Buses

This section explains

- SCSI bus bandwidth
- SCSI IDs
- SCSI bus type
- data transfer rates

SCSI Bus Bandwidth

A bus on an Ultra SCSI board is 16 bits wide. The host system negotiates with the target SCSI peripheral as to how many bits of data to send in each clock, 8 (narrow SCSI) or 16 (wide SCSI). Regardless of how the bus is utilized, it remains 16 bits wide.

SCSI IDs

Since the default SCSI bus controller is 0, 8-bit buses use seven SCSI IDs for devices, and 16-bit buses use 15 SCSI IDs. For an Ultra SCSI board attached to two Origin Vaults, the first Origin Vault's 3.5-inch disks are numbered 1 through 6 and the second Origin Vault's disks are numbered 9 through 14.

In narrow mode, there may be eight target SCSI IDs, minus the number of IDs for hosts on the bus. The target IDs must not conflict with the host ID; if there is more than one host, their IDs also must not conflict with each other. Similarly, in wide mode, there are 16 target SCSI IDs minus the number of hosts. (The default SCSI bus controller ID can be reconfigured for dual-hosted SCSI operation.)

SCSI Bus Type

A SCSI bus type is either single-ended or differential. A single-ended SCSI peripheral uses inexpensive, open-collector-wired, OR busing configurations that use a signal comparison to ground. This design limits the distance the signal can be driven because of noise considerations.

Differential SCSI peripherals use differential drivers and receivers with built-in hysteresis to provide improved signal noise immunity so that the bus can be driven greater lengths. Table 1-2 summarizes maximum cable lengths for the various SCSI options.

Table 1-2 Maximum Cable Lengths for SCSI Options

SCSI Flavor	Channel	Maximum Cable Length
Differential Fast-20	0, 1, 2, 3	25 m
Differential Fast-10 wide	0, 1, 2, 3	25 m
Single-ended	0	6 m

Table 1-2 (continued) Maximum Cable Lengths for SCSI Options

SCSI Flavor	Channel	Maximum Cable Length
Single-ended Fast-10	0	3 m
Single-ended Fast-20	0	1.5 m

Single-ended Fast-20 can support a maximum of eight devices, which must be evenly spaced along a 1.5-meter cable; a 3-meter cable can support a maximum of only four devices, evenly spaced. For Ultra SCSI boards in the Origin family of systems, single-ended Fast-20 is used exclusively inside the host system; differential Fast-20 is used for external SCSI buses.

Caution: Single-ended and differential SCSI peripherals use incompatible integrated circuitry and cannot be mixed on the same bus, unless converters are used.

SCSI Data Transfer Rate

Data transfer rates are either slow or fast, measured in megabytes per second. An operation is either 8- or 16-bit in size; thus, data transfer rates are dependent on bus bandwidth. Figure 1-4 compares data transfer rates.

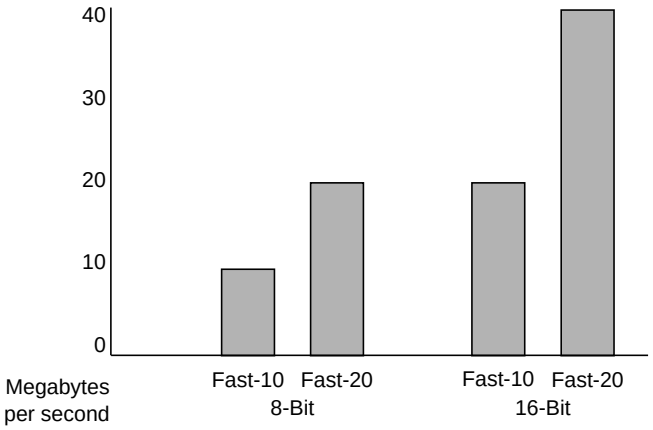

Figure 1-4 Maximum Burst Data Transfer Rates

Data transfer rate is also affected by the media speed of the SCSI peripheral.

Fast-20 SCSI is not merely “fast SCSI.” The “-20” in the term signifies the maximum number of megatransfers (number of million operations per bus cycle, based on a bus’s burst data rate) that can occur during an I/O operation, doubling the data rate. For example, an existing narrow 8-bit SCSI bus operating in fast mode can burst data at rates of 10 MB per second; the same bus running Fast-20 SCSI can burst data at 20 MB per second. An existing wide 16-bit SCSI bus in fast mode can burst data at 20 MB/sec, but the corresponding bus operating Fast-20 SCSI can burst data at 40 MB/sec.

SCSI Configuration Guidelines

These guidelines reflect the dependencies among SCSI bus bandwidths, types, and data transfer rates. Follow these guidelines help to minimize inconsistent or inoperable SCSI buses:

- Install single-ended and differential devices on separate buses.
- In calculating SCSI bus length, include all cable length inside devices, components, and chassis.
- For maximum performance, install wide and narrow SCSI devices on different buses.

Configuring a SCSI Channel

To configure a SCSI channel, you must verify the type of SCSI protocol required (single-ended/differential, data transfer rate), identify each component in the SCSI channel, and obtain any missing components.

Because the system controller negotiates independently with the devices on a bus to establish the acceptable transfer rate of each device, you can mix fast and slow devices on the same bus. However, mixing narrow Fast-20 and wide Fast-20 devices on the same single-ended SCSI bus is not recommended.

Chapter 2

Ultra SCSI Option Topologies

An Origin2000 deskside or rackmount chassis and an Onyx2 rackmount module can support up to eight Ultra SCSI boards, resulting in up to 32 SCSI channels. An Onyx2 deskside chassis can have up to three Ultra SCSI boards, for a total of 12 SCSI channels. Figure 2-1 diagrams how the Ultra SCSI board fits into the overall Origin2000/Onyx2 I/O structure.

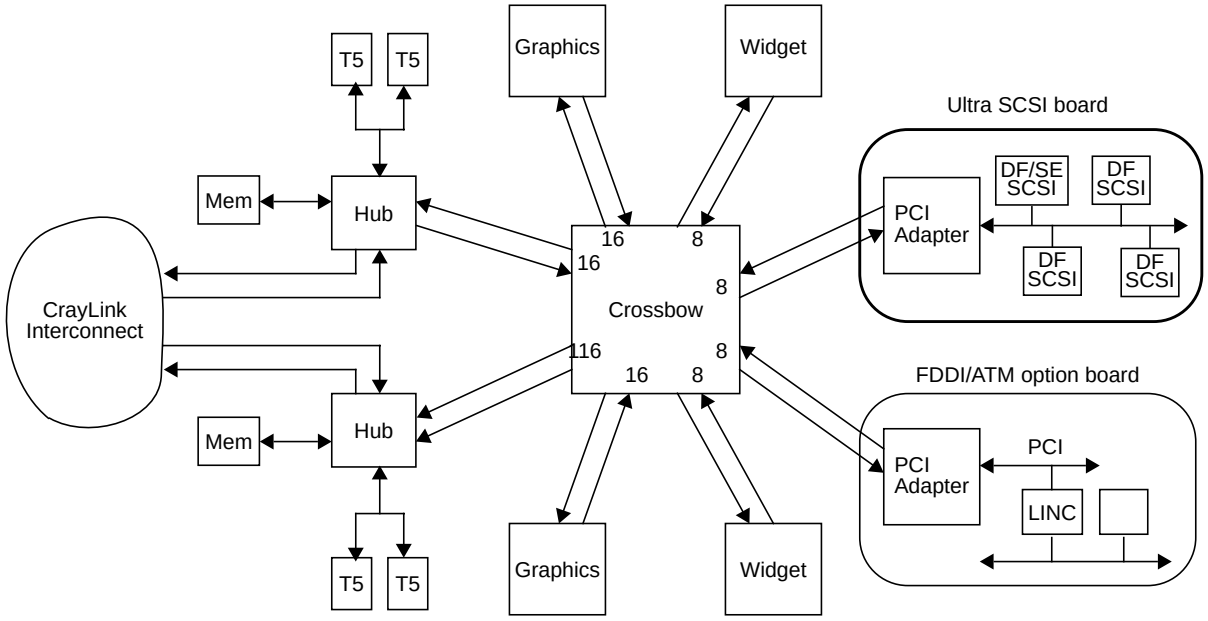

Figure 2-1 Ultra SCSI Option Board and Origin2000 I/O Structure

Cabling for single-ended storage cannot exceed one meter; cabling for differential storage cannot exceed 25 meters.

The Ultra SCSI board supports database, media, and throughput configurations. This chapter discusses:

- topologies with CHALLENGE Vault storage
- topologies with Origin Vault storage

Note: For ease of reading, CHALLENGE is written as Challenge in the balance of this guide.

Topologies With Challenge Vault Storage

Figure 2-2 diagrams a database topology using Challenge Vault storage. Designed to maximize storage capacity, this topology uses serial striping across the disks.

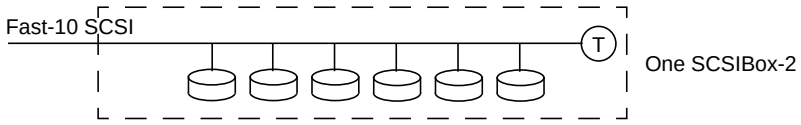

Figure 2-2 Database Topology: Challenge Vault Storage

Figure 2-3 diagrams a topology for media installations that offers bandwidth as well as high storage capacity.

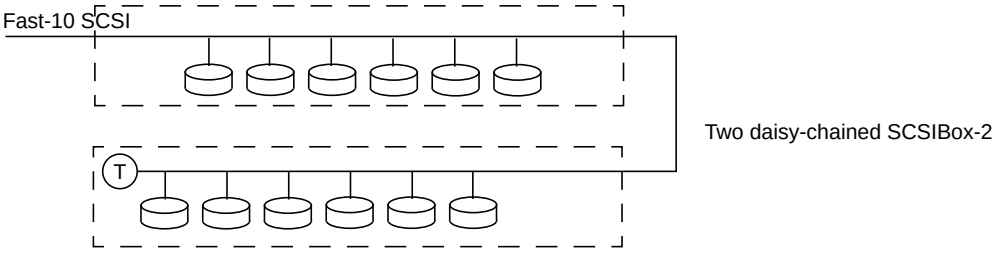

Figure 2-3 Media Topology: Challenge Vault Storage

Figure 2-4 diagrams a throughput configuration that offers bandwidth and high IOPs.

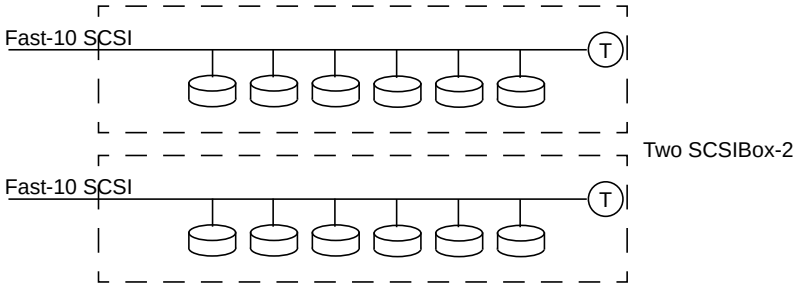

Figure 2-4 Throughput Topology: Challenge Vault Storage

Note: Fast-20 SCSI is not available for Challenge Vault storage.

Topologies With Origin Vault Storage

Figure 2-5 diagrams a topology using single-ended storage. For the differential part of the path, the total differential length of all connections cannot exceed 25 m.

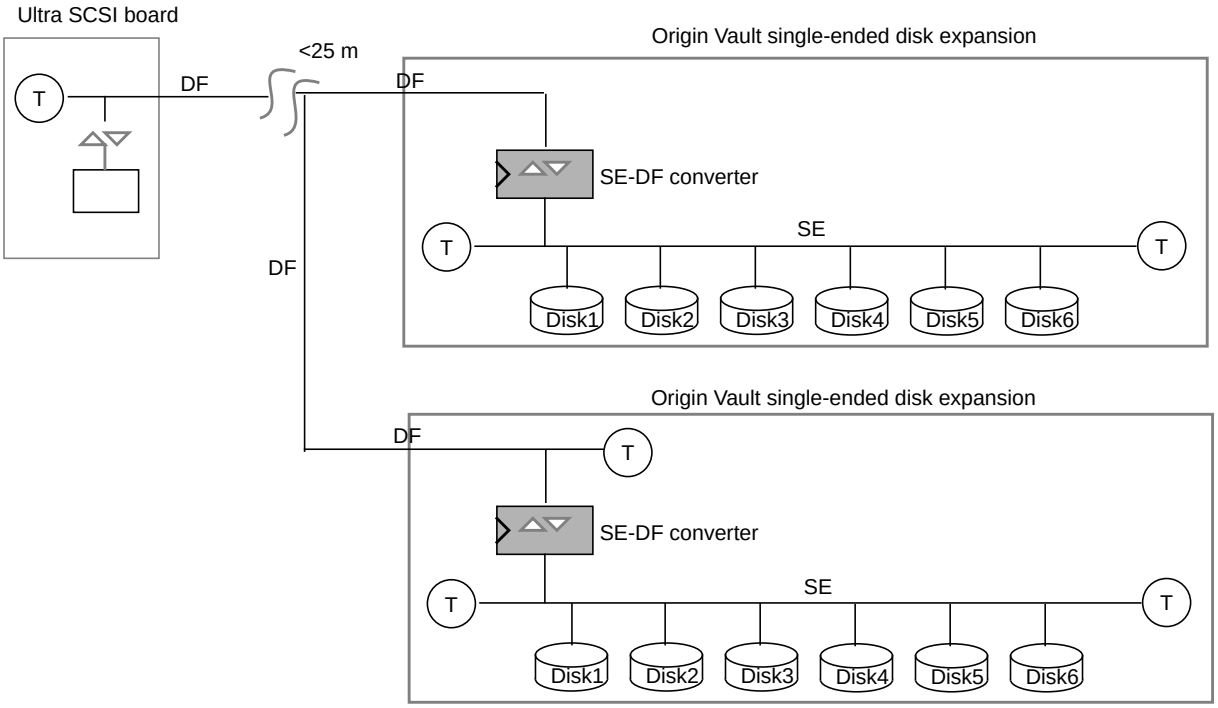

Figure 2-5 Single-Ended Fast-20 Option

The Origin Vault with six drives fills storage needs in a high-capacity configuration. Figure 2-6 diagrams a database topology using Origin Vault storage.

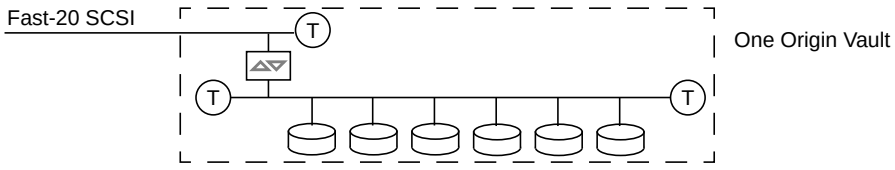

Figure 2-6 Database Topology

Figure 2-7 diagrams a throughput configuration that offers bandwidth and high IOPs.

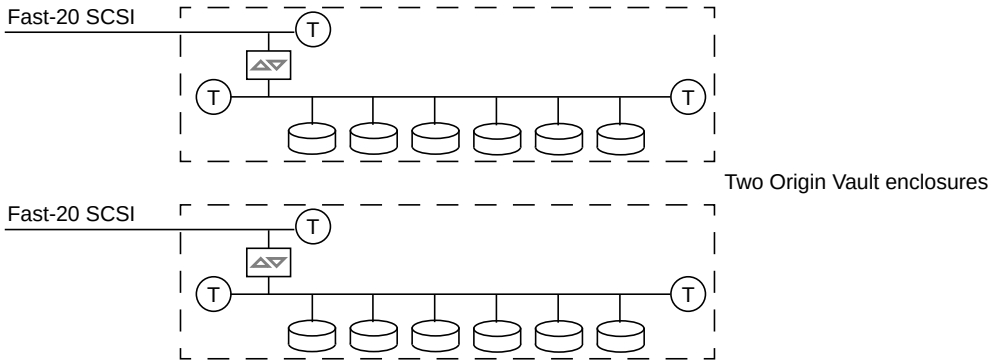

Figure 2-7 Throughput Topology: Challenge Vault Storage

In a high-bandwidth Fast-20 configuration, three Fast-20 drives fully utilize a single Fast-20 bus; additional drives provide no incremental increase in throughput, although they of course provide additional capacity. Four channels on one Ultra SCSI board configured this way fully utilize the PCI bus that these channels are on.

Appendix A

Ultra SCSI 68-Pin Connector Pinouts

Table A-1 lists pinouts for the 68-pin standard differential (wide bus) SCSI connectors on the Ultra SCSI cables.

Table A-1 Ultra SCSI P Connector Pinouts

Signal Name	Pin Number	Pin Number	Signal Name
+DB(12)	1	35	-DB(12)
+DB(13)	2	36	-DB(13)
+DB(14)	3	37	-DB(14)
+DB(15)	4	38	-DB(15)
+DPARH	5	39	-DPARH
+Ground	6	40	-Ground
+D0	7	41	-D0
+D1	8	42	-D1
+D2	9	43	-D2
+D3	10	44	-D3
+D4	11	45	-D4
+D5	12	46	-D5
+D6	13	47	-D6
+D7	14	48	-D7
+DPAR	15	49	-DPAR
DIFFSENS	16	50	Ground
TERMPWR	17	51	TERMPWR
TERMPWR	18	52	TERMPWR
Reserved	19	53	Reserved
+ATN	20	54	-ATN
Ground	21	55	Ground
+BSY	22	56	-BSY
+ACK	23	57	-ACK
+RST	24	58	-RST
+MSG	25	59	-MSG
+SEL	26	60	-SEL
+C/D	27	61	-C/D
+REQ	28	62	-REQ
+I/O	29	63	-I/O
Ground	30	64	Ground
+DB(8)	31	65	-DB(8)
+DB(9)	32	66	-DB(9)
+DB(10)	33	67	-DB(10)
+DB(11)	34	68	-DB(11)

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